

NDSEG

No more than 500 words and no special formatting required for each essay.

Answer the following:

- **What are your short and long-term professional goals?**
- **How did these goals develop?**
- **How have you already begun to lay the foundation for these goals?**
- **How does this fellowship fit into these goals?**

Use the space provided to complete your personal essay.

This essay is about the literal objectives

Short Term

- Traj generation -> Applications to UAVs
- Hybrid control -> mobile robotics

-> How did they develop

- Drone autonomy and how autonomy pipelines need research
- Disaster response -> speed in contested environments

Long Term

- Contribute to robotic path planning and mapping

-> How did they develop

- Tie in backpacking?

-> how have you laid the foundation for these goals

- UG Research
- Internship
- Teaching + mentoring through turtle logistics, hatchling mentorship, design reviews

Support -> financial, ARL, etc

- Army funding for ARL work
- UAV dominance

DOD ARO BAA

- Advanced Unmanned Aerial Systems (UAS) Technologies
- Topic ID: ARL-BAA-0100
 - maneuvering, and control
 - including route planning, GPS-denied robust navigation, obstacle avoidance
 - modeling and simulation strategies.
 - Control systems
 - GPS-denied robust navigation
- Artificial Intelligence and Machine Learning-Enabling Technologies for Expeditionary Maneuver and Air/Ground Reconnaissance
- Topic ID: ARL-BAA-0037
 - autonomous actors
 - Expeditionary maneuver and air/ground reconnaissance
 - Air/ground reconnaissance

- autonomous sensor platforms
 - Optimal performance of these missions will require improvements in autonomous agents, sensors, and edge computing.
- Computational Modeling of Aviation Systems
- ARL-BAA-0101
 - Modeling and simulation of control systems
 - No hardware :(

I grew up backpacking and wandering through the woods. Small errors in a bearing can make the difference of miles when bushwacking. I am passionate about understanding how navigation works under uncertainty. My mission is to develop autonomous navigation and trajectory generation methods that improve navigation when uncertainty is large, like in GPS-denied and RF-denied environments. Today, that mission aligns directly with the Army's goals in Advanced Unmanned Aerial System Technologies, and AI-enabled expeditionary maneuver and reconnaissance. These technologies depend on robust control, validated navigation, and novel autonomy to enable agents to complete missions in contested environments.

My short-term professional goal is to pursue graduate research through a Ph.D. focused on probabilistic trajectory generation and hybrid control for autonomous aerial and underwater vehicles. I want to develop navigation methods for autonomous systems to generate **dynamically feasible trajectories under degraded sensing, operate effectively under uncertain localization, or navigate in contested environments.**

In the long term, I hope to develop mobile autonomous systems that can operate with greater effectiveness without reliable sensor input. I intend to contribute to rapid and reliable path-planning and navigation for mobile autonomous robotic systems used in national defense and humanitarian operations. Future deployment and dominance of drones, submarines, and ground robots will depend on autonomous systems that can operate with greater confidence in contested areas with less information.

I have laid the foundation for my work in autonomous systems for my entire academic career. At Texas A&M, I entered the Interdisciplinary Engineering Program to develop and pursue a custom Robotics and Controls Engineering degree program. Through this program, I authored my own ABET-accredited degree that combined the control systems from mechanical engineering, signal processing from electrical engineering, and the data structures and algorithms from computer science. Outside of academics, I joined TURTLE Robotics to get hands-on experience building robots. Through TURTLE, I pitched and founded the Disaster Response Observation Network (DRON) project. DRON is a student project for rapid structural fire scene assessment, meant to aid first responders in disaster response. As project lead, I oversaw the design of a custom airframe, integration of sensors, development of system autonomy, implementation of multimodal perception, and validation trials in field tests. I spent my final undergraduate summer working in the Aerial Autonomy group in the Army Research Lab focusing on autonomous drone wire-perching and optical-flow-based perception. I implemented methods for onboard wire detection and depth estimation in GPS-denied

environments and validating systems. I also worked on calibration methods for optical flow inertial depth mapping.

The National Defense Science and Engineering Graduate Fellowship Program would allow me to pursue graduate research to benefit emergency response and UAS autonomy. It would allow me to pursue intensive graduate training in autonomy while contributing to DoD-relevant research in probabilistic planning, multi-domain robotics, and resilient autonomy for contested environments. The fellowship's support would allow me to conduct meaningful research to prepare for a career developing autonomous systems that can navigate uncertainty, accelerate response, and save lives.

Personal story statement to describe the Fellows personal journey to get where they are today (e.g., 1st to receive PHD, 1st to go to college, worked multiple positions while achieving degree, what it took personally to get to where they are, etc...)

This is about everything as a person and how it made me the person I am

Journey Of Leadership/ Personal Introduction (Trauma dump)

- Seb -> missed the call
 - Summer camp. Seven days in the woods. I'll call you on Sunday. I had a blast; they invited me to stay. I didn't have service. Missed call. His stepmom found him. They rushed him to the hospital. He was okay. That time.
- Mom -> made the call
 - When I was 15 years old, I woke up to find my mom dead at the kitchen table. I called 911 as I watched my dad give her CPR on the kitchen floor. Years of first aid training, survival kits, and emergency food rations, yet there was nothing we could do. When seconds count, help is minutes away. I want to build systems that bring help to crises faster.
- Philmont -> disaster response
 - When I was 17 and volunteering at the state level for the Order of the Arrow, I had an advisor suggest I apply to a backpacking scholarship. I always went to Scouting Summer Camp because I sold the popcorn and coupon cards to pay for it. and because of that generosity I had the chance to climb the same mountains as my dad. I spent my first undergraduate summer working as a Conservation Foreman for Philmont Scout Ranch with the Order of the Arrow Trail Crew program. Over the summer, I led 40 teenagers to complete more than 2000 man-hours of conservation work to cut new trail at 12,000 feet in a burn scar left by a wildfire. A wildfire that scorched 36,740 acres and took 604 trained personnel nearly three weeks to contain. A wildfire that could have been prevented if the rural fire departments had access to higher quality mapping to contain the fire before it grew. It was only after the devastation that the local forestry groups received state funding for manually piloted response drones. Years later, leading trail crews through burn scars of that same wildfire, I saw firsthand how the lack of access to modern systems delayed fire containment. When seconds mattered, the hardware was hundreds of miles away. I want to develop autonomous systems that can save lives when human response alone can't keep pace.
- Narrative
 - NSF personal statement
 - In autonomy, triage, and disaster response, seconds count. My mission is to develop rapid, robust trajectory generation methods for autonomous vehicles operating in hazardous environments, empowering disaster mapping and emergency response.
 - DOD NDSEG goals tie in
 - They want autonomous drones and AI/hybrid navigation

Seconds count.

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When I was 17 an advisor recommended that I apply for a backpacking scholarship the section offered. I always went to Scouting Summer Camp because I sold popcorn and coupon cards to pay for it, and because of his generosity, I had the chance to climb the same mountains as my dad. I spent my first undergraduate summer working as a Conservation Foreman for Philmont Scout Ranch with the Order of the Arrow Trail Crew program. Over the summer, I led 40 teenagers to complete more than 2000 man-hours of conservation work cutting new trail at 12,000 feet in a burn scar left by a wildfire. That wildfire scorched 36,740 acres and took 604 trained personnel nearly three weeks to contain. It was only after the devastation that the local forestry groups received state funding for manually piloted response drones. It could have been prevented if the rural fire departments had access to higher quality mapping to contain the fire before it grew. Years later, leading trail crews through burn scars of that same wildfire, I saw firsthand how the lack of access to modern systems delayed fire containment. When seconds mattered, the hardware was hundreds of miles away.

In autonomy, triage, and disaster response, seconds count. My mission is to develop rapid, robust trajectory generation methods for autonomous vehicles operating in hazardous environments, empowering disaster mapping and emergency response. I intend to develop advanced UAS technologies and resilient navigation systems by pursuing a PhD in trajectory generation and probabilistic planning. I am committed to work to benefit emergency response and UAS autonomy. I am passionate about working in probabilistic planning, multi-domain robotics, and resilient autonomy. I believe in the purpose of developing improved navigation systems for contested environments.

When seconds count, we need systems that can respond in time.